AI Overview

The convergence of game scenarios via finite element methods maps continuous strategic interactions—such as **Mean Field Games (MFGs)** with infinite players—onto discrete spatial and temporal meshes. As the mesh size (h) approaches zero, numerical solutions for value and density functions converge to the true Nash equilibrium. YouTube · Ansys Learning +2

Core Concepts of Finite Element Convergence in Games

Mean Field Game Discretization

- **Continuous Limits:** MFGs couple a Hamilton–Jacobi–Bellman (HJB) equation for individual player value with a Kolmogorov–Fokker–Planck (KFP) equation for population density.
- **Mesh Approximation:** Continuous spaces are split into finite geometric elements (polytopes or simplices).
- **Nondifferentiable Hamiltonians:** Advanced convergence theorems handle non-smooth or subdifferential cost structures using monotone stabilized finite elements.

Error Bounds and Norms

- **H^1-Norm Convergence:** Measures the error rate of the value function (the player's optimal strategy/cost-to-go), typically scaling linearly with mesh refinement (O(h) for linear elements). YouTube · Ansys Learning +1
- **L^2-Norm Convergence:** Measures the error rate of the population density distribution, often achieving higher-order convergence via duality arguments like the Aubin–Nitsche trick. YouTube · Ansys Learning +1
- **Rate Proofs:** Error bounds depend explicitly on the polynomial degree of the finite element basis functions and the inherent smoothness of the game's exact equilibrium. YouTube · Ansys Learning

- The mathematical formulation of the **HJB-KFP coupling**?
- Specific **error estimation proofs** using Sobolev spaces?
- Application to **N-player differential games** versus the mean field limit?

AI can make mistakes, so double-check responses

Ask anything

NSF Public Access Repository (.gov)
https://par.nsf.gov › servlets › purl

PDF

On convergence rates of game theoretic reinforcement ...

arXiv
https://arxiv.org › pdf

Rates of convergence of finite element approximations of ... PDF

by YAP Osborne · 2025 · Cited by 9 — We prove a rate of **convergence** for **finite element** approximations of stationary, second-order mean field **games** with nondifferentiable ... Read more

ResearchGate
https://www.researchgate.net › figure › Convergence-of...

1. Convergence of the finite element method for an exact ...

This conjecture is supported both by physical arguments and numerical evidence. We then prove a general **theorem** which bounds the error made by a **finite element** ... Read more

Durham Research Online (DRO)
https://durham-repository.worktribe.com › Output...

Finite element approximation of time-dependent mean field ... PDF

by YAP Osborne · 2024 · Cited by 26 — Our main **convergence** result is in **Theorem** 5.3, which shows the **convergence** of numerical approximations. In this paper, we give a constructive proof of **Theorem** ...

The Association for the Advancement of Artificial Intelligence
https://ojs.aaai.org › AAAI › article › view

On the Convergence of Model Free Learning in Mean Field ... PDF

by R Elie · 2020 · Cited by 139 — A mean field (MF) Nash equilibrium arises when the dis- tribution of the best response policies over the population generates the exact same population flow. In ... Read more

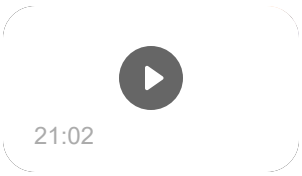
Archive ouverte HAL
https://hal.science › preview › 1805.05940.pdf

Finite mean field games: fictitious play and convergence to ... PDF

by S Hadikhanloo · 2018 · Cited by 86 — Under an analogous monotonicity assumption, we prove in Theorem 4 that the **fictitious play procedure converges also in the case of finite MFGs**. Read more

YouTube · Jack Chessa
18.2K+ views · 14 years ago

Convergence of finite elements



Some basic theory on the convergence of finite elements and **how to determine the convergence rate** theoretically and experimentally.

Computational Science Stack Exchange
https://scicomp.stackexchange.com › questions › l2-con...

convergence of finite element method when right hand side ...

Feb 3, 2017 — I know that the piecewise linear finite element approximation uh of Δu(x)=f(x)in Uu(x)=0on ∂U satisfies ‖u−uh‖H10(U)≤Ch‖f‖L2(U) provided ...

1 answer · Top answer: Yes, this is the standard Aubin-Nitsche (or duality) trick. The idea is to use the f…

Missing: ~~scenarios:~~ | Show results with: scenarios:

Springer Nature Link
https://link.springer.com › Numerische Mathematik

Finite element approximation of time-dependent mean field ...

by YAP Osborne · 2025 · Cited by 26 — We prove the strong **convergence** in of the value function approximations, and strong **convergence** in of the density function approximations, ... Read more

Results are personalized - Try without personalization

Canada **H2V, Montreal, QC** - From your IP address - Update location

Help Send feedback Privacy Terms